

(19)



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Office européen des brevets



(11)

EP 0 921 458 A2

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

09.06.1999 Bulletin 1999/23

(51) Int. Cl.⁶: G06F 1/26

(21) Application number: 98250420.1

(22) Date of filing: 02.12.1998

(84) Designated Contracting States:

AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE

Designated Extension States:

AL LT LV MK RO SI

(30) Priority: 02.12.1997 JP 33173097

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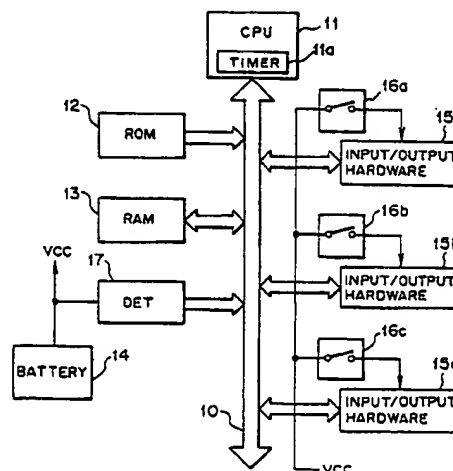
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(54) Information terminal device with power control means

(57) A driver (21a-21c) stores an electricity consumption value of corresponding input/output hardware (15a-15c). The stored electricity consumption value is registered in an electricity consumption value table (30) in accordance with a setting of the driver when an operating system carries out an input/output function. When an application program (22a-22c) requires to use the input/output function, the operating system (20) judges whether or not the required input/output of data can be stably carried out with the remaining quantity of the battery (14) measured by a battery remaining quantity measuring instrument (17), and it is judged that the input/output can be carried out stably, the operating system allows a corresponding driver to drive the input/output hardware. With this feature, the operation of an input/output device is prevented from being unstabilized due to shortage of battery volume without changing an operating system even when electricity consumption of the input/output device is varied due to a setting or the input/output device is exchanged or newly added.

FIG. 2



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battery remaining quantity measuring means is enough for carrying out such a required input or output of data with the electricity consumption registered in the electricity consumption registering means; and an input/output permitting means for permitting the input/output device to carry out the input or output of data when the judging means judges that the battery remaining power/quantity is enough.

[0013] In the above information terminal device, when the judging means judges that there is enough battery remaining quantity, input or output of data by the input/output device is permitted by the the permitting means. Therefore, when the battery remaining quantity is not enough, data is not input or output in an unstable operational state. Further, in the information terminal device, the electricity consumption of the input/output device stored in the driving means is registered in the electricity consumption registering means. Then, the judging means judges in accordance with the registered electricity consumption. Therefore, even when the input/output device is exchanged or newly added, it is unnecessary to make changes in any other portion than a driving means corresponding to such exchanged or newly added input/output device.

[0014] In the above information terminal device, electricity consumption of the input/output device may be varied depending upon a setting of the driving means. In such a case, the driving means stores electricity consumption of the input/output device for every setting; the information terminal device further comprises; a setting changing means for changing the setting of the driving means when the judging means judges that the battery remaining quantity is not enough; and a re-registering means for registering, in the electricity consumption registering means, the electricity consumption stored in the driving means corresponding to a setting which is changed by the setting changing means.

[0015] In this case, electricity consumption corresponding to the changed setting is re-registered in the re-registering means by changing the setting of the driving means by the setting changing means, and the input/output device can be operated in accordance with the re-registered electricity consumption. Therefore, it is possible to allow the input/output device to operate needed operation as much as possible. In this case also, it is unnecessary to make any change in other portions.

[0016] An information terminal device driven by a battery according to a second aspect of the invention comprises: an input/output device; a battery remaining quantity measuring means for measuring a remaining quantity of the battery; a driving means for operating the input/output device; an electricity consumption measuring means for measuring electricity consumption when the driving means operates the input/output device; an electricity consumption registering means for registering the electricity consumption measured by the electricity consumption measuring means; a judging means

for judging, when input or output of data to or from the input/output device is required, whether or not the battery remaining quantity measured by the battery remaining quantity measuring means is enough for carrying out such a required input or output of data with the electricity consumption registered in the electricity consumption registering means; and an input/output permitting means for permitting the input/output device to carry out the input or output of data when the judging means judges that the battery remaining quantity is enough.

[0017] In the above information terminal device, when the judging means judges that there is enough battery remaining quantity, input or output of data by the input/output device is permitted by the permitting means. Therefore, when the battery remaining quantity is not enough, data is not input or output in an unstable operational state. Further, in the information terminal device, the electricity consumption of the input/output device measured by the electricity consumption measuring means is registered in the electricity consumption registering means. Therefore, when the input/output device is used a second time or subsequent time, the judging means judges in accordance with this registered electricity consumption. For this reason, even if the electricity consumption of the input/output device corresponding to the driving means is not stored, the same effect as that of the information terminal device of the first aspect can be obtained. Further, even if the input/output device is changed or newly added, it is unnecessary to make change in other portions other than the driving means corresponding to the changed or newly added input/output device.

[0018] In the information terminal of the first or second aspect, the judging means may comprise: a completion time calculating means for calculating time required for completing the required input or output of data to or from the input/output device; an operational time calculating means for calculating a continuous operational time of the input/output device with electricity consumption registered in the electricity consumption registering means within the battery remaining quantity measured by the battery remaining quantity measuring means; and a comparing means for comparing the time calculated by the completion time calculating means with the time calculated by the operational time calculating means.

[0019] In the information terminal of the first or second aspect, the input/output device may be provided plurally. In that case, the driving means is provided for each of the input/output devices correspondingly; the electricity consumption registering means stores electricity consumption stored in each of the driving means associated with the input/output devices or the driving means; and the judging means judges whether electricity consumption associated with the input/output device or the driving means for carrying out the required input or output of data is enough for carrying out the required input

a permitting step for driving the driver for allowing the input/output device to carry out the input or output of data when the judging step judges that the battery remaining quantity is enough.

[0030] According to the present invention, when the battery remaining quantity is not enough, data is not input or output in unstable operational state. Further, when an input/output device is changed or newly added, it is unnecessary to make a change in any portion other than the driving means (driver) corresponding to such a changed or newly added electricity consumption device. [0031] Further, when electricity consumption of the input/output device is varied by the setting of the driving means (driver), it is possible to allow the input/output to operate as much as possible by changing the setting of the driving means (driver) to a lower electricity consumption side.

BRIEF DESCRIPTION OF THE DRAWINGS

[0032]

Fig.1 is a functional block diagram showing a functional structure of a conventional portable information terminal device;

Fig.2 is a block diagram showing a circuit structure of a portable information terminal device according to an embodiment of the present invention;

Fig.3 is a functional block diagram showing a functional structure of the portable information terminal device according to the embodiment of the present invention;

Figs.4A and 4B are views for showing an address structure of a driver shown in Fig.2, wherein Fig.4A shows a case in which a corresponding hardware has a single electricity consumption value, and Fig.4B shows a case in which the electricity consumption value of the corresponding input/output hardware can be changed by setting;

Fig.5 is a flow chart showing a procedure for executing input/output function in the portable information terminal device according to the embodiment of the present invention;

Fig.6 is a flow chart showing a procedure for checking a battery remaining quantity in the portable information terminal device according to the embodiment of the present invention;

Fig.7 is a flow chart showing a procedure of a subroutine for initializing the driver;

Fig.8 is a flow chart showing a procedure in subroutine for changing the setting of the driver; and

Fig.9 is a block diagram showing a circuit structure of a portable information terminal device according to a modification of the embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0033] A preferred embodiment of the present invention will now be explained with reference to the accompanying drawings.

[0034] Fig.2 is a block diagram showing a circuit structure of a portable information terminal device according to the embodiment of the present invention.

[0035] As shown in Fig.2, the portable terminal device comprises a CPU 11, a ROM 12, a RAM 13, a battery 14, input/output hardware 15a to 15c, switches 16a to 16c and a battery remaining quantity measuring instrument (DET) 17. The CPU 11, the ROM 12, the RAM 13, the input/output hardware 15a to 15c, the switches 16a to 16c and the battery remaining quantity measuring instrument (DET) 17 are connected with each other through a bus 10.

[0036] The CPU 11 executes process programs which are stored in the ROM 12 and shown in the flow chart as will be described later. When the CPU 11 executes these programs, functions which will be described later are realized in the portable terminal device. The CPU 11 is provided therein with a timer 11a, and battery remaining quantity checking process which will be described later is carried out in accordance with interrupt requested at predetermined time intervals from the timer 11a.

[0037] The ROM 12 stores data used by or in the process program of the CPU 11. The ROM 12 stores programs of an operating system which will be described later (here, this means an operating system in a wide sense, and this includes drivers) or application programs. The ROM 12 is a non-volatile memory and thus, data is held even if the portable terminal device is turned OFF.

[0038] The RAM 13 is a volatile memory constituted by a semiconductor memory, and is used as a working area of the CPU 11.

[0039] In this portable terminal device, different addresses are allocated to the ROM 12 and RAM 13. The CPU 11 may directly read the process program from the ROM 12 and execute, or may transfer the process program stored in the ROM 12 to the RAM 13, and read the process program from the RAM 13 and execute. A program in which a setting of a driver is changed as will be described later is always transferred from the ROM 12 to RAM 13 and executed.

[0040] The battery 14 supplies electricity to various portions of the portable terminal such as input/output hardware 15a to 15c. The battery 14 may be a flashlight battery, a battery pack type battery, or a storage battery. The battery 14 may be one which is an external battery to be mounted to the outside the portable terminal device.

[0041] Although only three input/output hardware components 15a to 15c are shown in Fig. 2, the number of input/output hardware is not limited. Examples of the input/output hardware 15a to 15c are a keyboard for

[0057] First, when this portable information terminal device is turned on, a boot program is operated and the operating system 20 is started. The operating system 20 registers input/output function realized by the operating system 20 in the functional table 31, reads the electricity consumption value data 44, 44a to 44n based on default setting value, and registers the same in the electricity consumption value table 33. Then, the link information 32 is set with respect to the various function registered in the functional table 31 and electricity consumption values of the hardware 15a to 15c registered in the electricity consumption value table 33.

[0058] Then, any of the application programs 22a to 22c are executed by a user's request from the portable terminal device.

[0059] Next, it is supposed that input/output is requested by the application program 22a to 22c executed by the user's request. At that time, the application program transfers a setting value of the drivers 11a to 11c executed by function of the operating system 20 that corresponds to a request stored in the functional table 31, and data to be input or output, to the operating system 20 as parameters. Then, based on the transferred parameters, the processing "execution of input/output control" which is a function of the operating system 20 and is shown in the flow chart in Fig.5 is carried out.

[0060] When the processing of the flow chart shown in Fig.5 is started, the CPU 11 first moves to a subroutine "initialize drivers" which will be described later, and initializes the drivers 21a to 21c corresponding to the function (step S11). By this "initialize drivers", the electricity consumption corresponding to the setting value of the driver is registered in the electricity consumption value table 33.

[0061] When the processing of the subroutine of "initialize drivers" is completed, the CPU 11 returns to a main routine, and obtains the link information 32 from function registered in the functional table 31 that is requested by the application programs 21a to 21c (step S12). Then the CPU 11 judges whether or not the link information 32 is set with respect to the function (step S13).

[0062] If it is judged that the link information 32 is not set with respect to the function in step S13, the processing is advanced to an error processing in step S24 which will be described later.

[0063] If it is judged that the link information 32 is set with respect to the function in step S13, the CPU 11 obtains an address of the electricity consumption value in the electricity consumption value table 33 from the set link information 32 (step S14), and reads the electricity consumption value based on the obtained address (step S15).

[0064] Next, the CPU 11 obtains a remaining quantity of the battery 14 measured by the battery remaining quantity measuring instrument 17 (step S16), and estimates a continuous operational time during which the

corresponding input/output hardware 15a to 15c can continuously and stably be operated with the obtained remaining quantity of the battery 14 (step S17). Further, the CPU 11 calculates a function completing time that is necessary for completing the input/output function from the setting value of the driver transferred as the parameter and an amount of data to be input or output (step S18). The CPU 11 compares the continuously operational time estimated in step S17 and the function completing time calculated in step S18, and judges whether or not the continuous operational time is equal to or longer than the function completing time (step S19).

[0065] If it is judged that the continuous operational time is equal to or longer than the function completing time in step S19, the processing is advanced to step S20 which will be described later.

[0066] If it is judged that the continuous operational time is shorter than the function completing time in step S19, the CPU 11 judges whether it is possible to change the settings of the drivers for operating the input/output hardware 15a to 15c by the functions (step S21).

[0067] If it is judged that it is not possible to change the settings of the drivers in step S21, the processing is advanced to an error processing in step S24 which will be described later.

[0068] If it is judged that it is possible to change the settings of the drivers in step S21, the CPU 11 judges whether or not there is any other setting value capable of further reducing the electricity consumption of the corresponding input/output hardware 15a to 15c (step S22).

[0069] If it is judged that there is no setting value capable of further reducing the electricity consumption in step S22, the processing is advanced to error processing in step S24 which will be described later.

[0070] If it is judged that there is another setting value capable of further reducing the electricity consumption in step S22, the CPU 11 moves to a subroutine of "change of setting of drive" which will be described later, and the setting of the drivers 21a to 21c corresponding to this function is changed (step S23). The electricity consumption value whose electricity consumption is lower by one level is registered in the electricity consumption value table 33.

[0071] When the processing of the subroutine of "change of setting of driver" is completed, the CPU 11 returns to the main routine, and returns back to step S14, the same processing is continued based on the electricity consumption value newly registered in the electricity consumption value table 33.

[0072] Step S20 corresponds to a case in which there is enough remaining quantity of battery 14 for executing the function stably. Therefore, the CPU 11 executes the program of the driver body 42, and operates the corresponding input/output hardware 15a to 15c. With this operation, the corresponding input/output hardware 15a to 15c input or output data requested by the application programs 22a to 22c. Then, the processing of this flow

driver body 42 (step S46), and returns to the main routine.

[0091] Processing of subroutine of "Change in the setting of driver " in steps S23 and S38 will be explained with reference to a flow chart in Fig.8.

[0092] When the processing is started, the CPU 11 reads the electricity consumption value header information 43 of the corresponding drivers 21a to 21c (step S51). The CPU 11 judges whether or not the electricity consumption value is varied by the setting value from the read electricity consumption value header information 41 (step S52).

[0093] When it is judged that the electricity consumption value is not varied by the setting value in step S52, the processing is advanced to step S55.

[0094] When it is judged that the electricity consumption value is varied by the setting value in step S52, the CPU 11 refers the electricity consumption value header information 43 and reads the electricity consumption value data corresponding to the setting value among the electricity consumption value data 44a to 44n (Step S54). Further, the CPU 11 registers the electricity consumption value data which is read in step S53 in the corresponding address of the electricity consumption value table 33 (step S54). Then, the processing is advanced to step S55.

[0095] In step S55, the CPU 11 conducts the processing for changing the setting of the driver body 42, and the processing of this flow chart is completed.

[0096] As described above, in the portable terminal device according to the present embodiment, in order to continuously and stably operating the input/output hardware 15a to 15c even if the setting or set value of the link information 32 is changed, input/output function requested by the application programs 21a to 21c is not executed when the remaining quantity of the battery 14 is not sufficient (step S42). Therefore, it is possible to avoid unstable operation of the input/output hardware 15a to 15c when the remaining quantity of the battery 14 is not sufficient.

[0097] In the portable terminal device according to the present embodiment, since link information 32 having lower priority order is sequentially released by the processing of "checking of battery remaining quantity" executed in accordance with interrupt from the timer 11a, it is possible to reduce the electricity consumption when the remaining quantity of the battery 14 is not enough.

[0098] Further, in the portable terminal device according to the present embodiment, value is registered in the electricity consumption value table 33 and the link information 32 is set using the function of the operating system 20, and the operating system 20 controls the input/output based on the registered content in the electricity consumption value table 33 and the set link information 32. Therefore, even if the input/output hardware is changed or added, it is possible to cope with this without changing the operating system 20 if a correspond-

ing driver is added.

[0099] Further, in the portable terminal device according to the present embodiment, when the electricity consumption of the input/output hardware 15a to 15c is changed by setting value, even if there is not a sufficient remainder of the battery 14 for continuously and stably operating the input/output hardware 15a to 15c with the initial setting, it is possible to operate the input/output hardware 15a to 15c by changing the setting value. Therefore, it is possible to allow the input/output hardware to operate as much as possible.

[0100] In the above embodiment, the electricity consumption value of the input/output hardware 15a to 15c registered in the electricity consumption value table 33 is written in the corresponding drivers 21a to 21c as electricity consumption value data 44, 44a to 44n. As shown in Fig.9, an electricity consumption measuring instrument 18 may be added to the structure in Fig.2, and an electricity consumption value actually measured by this electricity consumption measuring instrument 18 may be registered in the electricity consumption value table 33. With this feature, even when the electricity consumption value table is not previously written in the drivers 21a to 21c, it is possible to cope with a variation in electricity consumption due to variation of characteristics of parts, or new compatible parts (such as PC card modem) which is announced after the registration to the drivers 21a to 21c.

[0101] In the above embodiment, the processing shown in the flow chart in Fig. 6 is executed in accordance with the interruption from the timer 11a in the CPU 11. This processing in the flow chart may be executed when the portable terminal device is turned ON.

[0102] The above embodiment has been described while taking the case where the entire portable terminal device is driven by electricity supplied from the battery 14. However, the present invention can be applied to a case where only the input/output hardware is driven by a battery. In this case, battery remaining quantity measuring means may be provided such as to correspond to the input/output hardware, and when a function of the requested input/output utilizes the input/output hardware which is driven by the battery, the same processing as described above may be carried out.

[0103] Although the above embodiment has been described while taking the case where the present invention is applied to the portable terminal device, the present invention can be applied to any types of information terminal devices which are driven by batteries (business power source supplied from electric power company may be used together) and which drive the input/output hardware.

[0104] In the above embodiment, the operating system 20 and programs of the drivers 21a to 21c which realize the function of the present invention are stored in the ROM 12. However, these programs may be stored in a floppy disk or CD-ROM and supplied, as may be installed in a hard disk provided in the portable terminal

stores electricity consumption stored in each of said driving means associated with said input/output devices or said driving means; and said judging means judges whether electricity consumption associated with said input/output device or said driving means for carrying out said required input or output of data is enough for carrying out said required input or output of data.

6. An input/output control method for controlling an input/output device driven by a battery and by a driver in which electricity consumption of a corresponding input/output device is stored, comprising:

an electricity consumption registering step for registering the electricity consumption of said input/output device stored in said driver;
a battery remaining quantity measuring step for measuring said battery remaining quantity when input or output of data to or from said input/output device is required;
a judging step for judging whether or not said battery remaining quantity measured by said battery remaining quantity measuring step is enough for carrying out such a required input or output of data with said electricity consumption registered in said electricity consumption registering step; and
a permitting step for driving said driver for allowing said input/output device to carry out said input or output of data when said judging step judges that said battery remaining quantity is enough.

7. An input/output control method according to claim 6, wherein

an electricity consumption of said input/output device is varied depending upon a setting of said driver;
said driver stores electricity consumption of said input/output device for every setting;
said input/output control method further comprises;
a setting changing step for changing the setting of said driver when said judging step judges that said battery remaining quantity is not enough; and
an electricity consumption re-registering step for substituting and re-registering electricity consumption stored in said driver corresponding to a setting which is changed by said setting changing step for electricity consumption registered in said registering step.

8. An input/output control method for controlling an input/output device driven by a battery and by a

driver, comprising:

an electricity consumption measuring step for measuring electricity consumption when said driver operates said input/output device;
an electricity consumption registering step for registering the electricity consumption measured by said electricity consumption measuring step;
a battery remaining quantity measuring step for measuring a remaining quantity of said battery when input or output of data to or from said input/output device is required;
a judging step for judging whether or not said battery remaining quantity measured by said battery remaining quantity measuring step is enough for carrying out such a required input or output of data with said electricity consumption registered in said electricity consumption registering step; and
a permitting step for driving said driver for allowing said input/output device to carry out said input or output of data when said judging step judges that said battery remaining quantity is enough.

9. A storing medium for storing a program for realizing an input/output control method for controlling an input/output device driven by a battery and by a driver in which electricity consumption of a corresponding input/output device is stored, comprising:

an electricity consumption registering step for registering the electricity consumption of said input/output device stored in said driver;
a battery remaining quantity measuring step for measuring said battery remaining quantity when input or output of data to or from said input/output device is required;
a judging step for judging whether or not said battery remaining quantity measured by said battery remaining quantity measuring step is enough for carrying out such a required input or output of data with said electricity consumption registered in said electricity consumption registering step; and
a permitting step for driving said driver for allowing said input/output device to carry out said input or output of data when said judging step judges that said battery remaining quantity is enough.

10. A storing medium readable by a computer according to claim 9, wherein

electricity consumption of said input/output device is varied depending upon a setting of said driver;

FIG.1
(PRIOR ART)

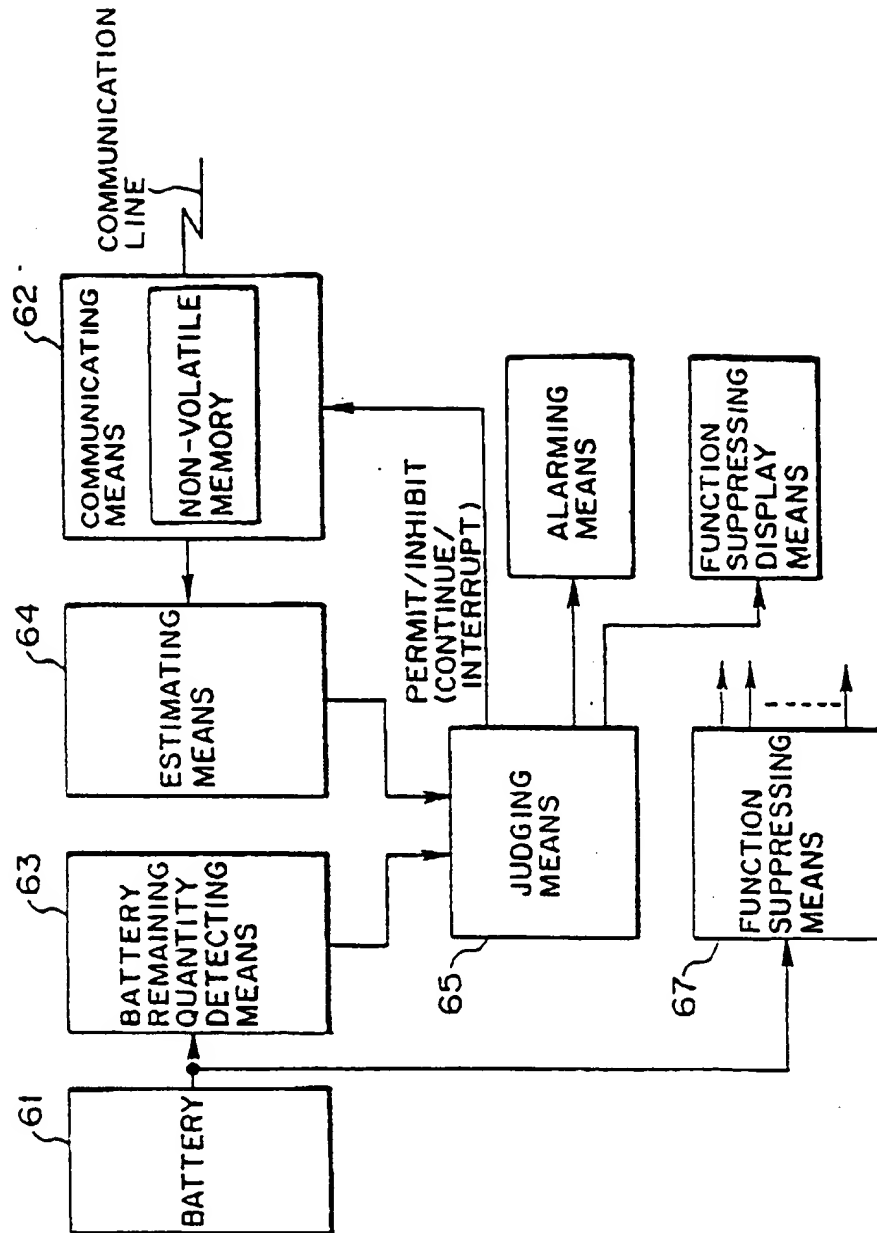


FIG. 3

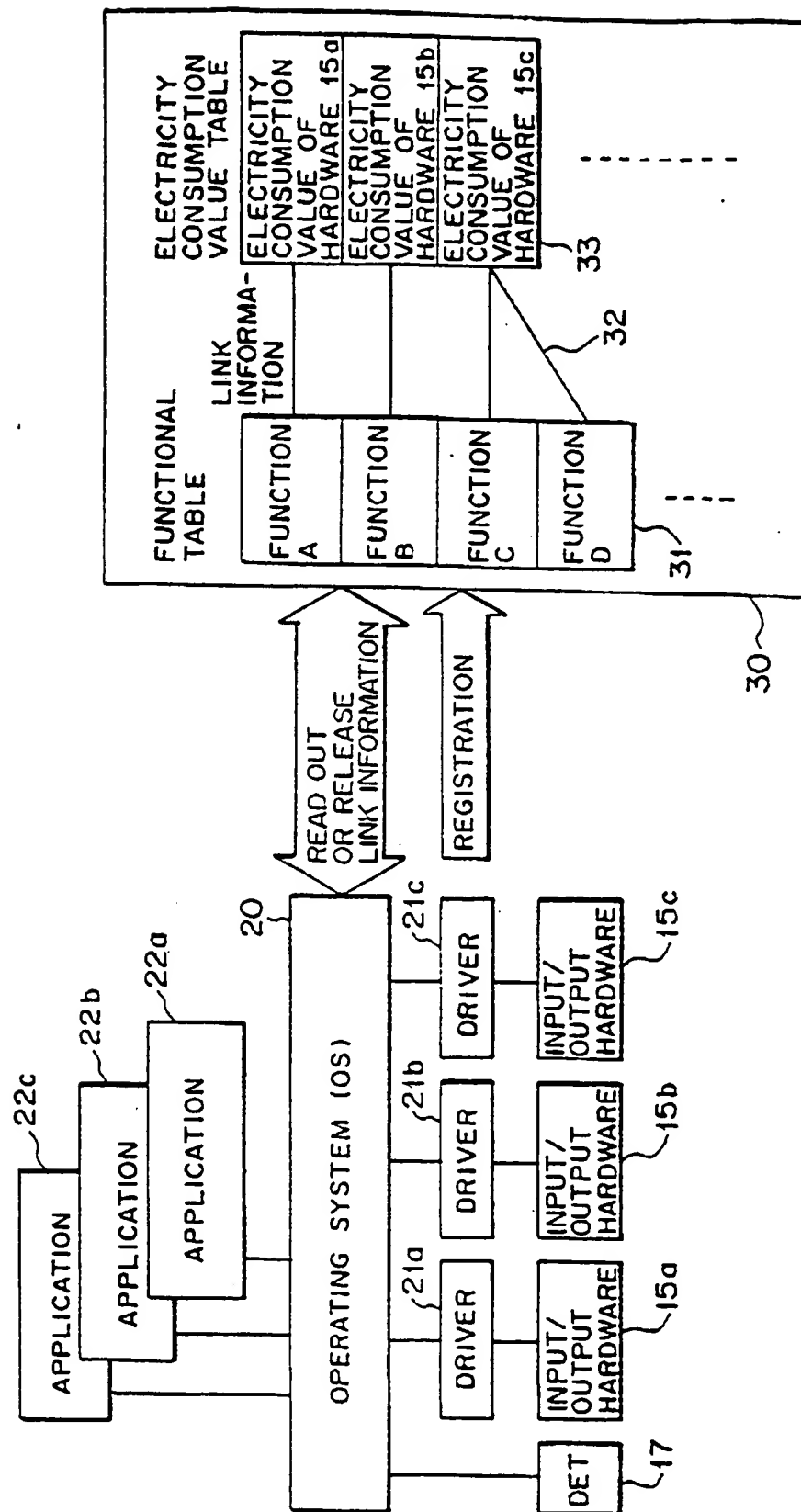


FIG. 5

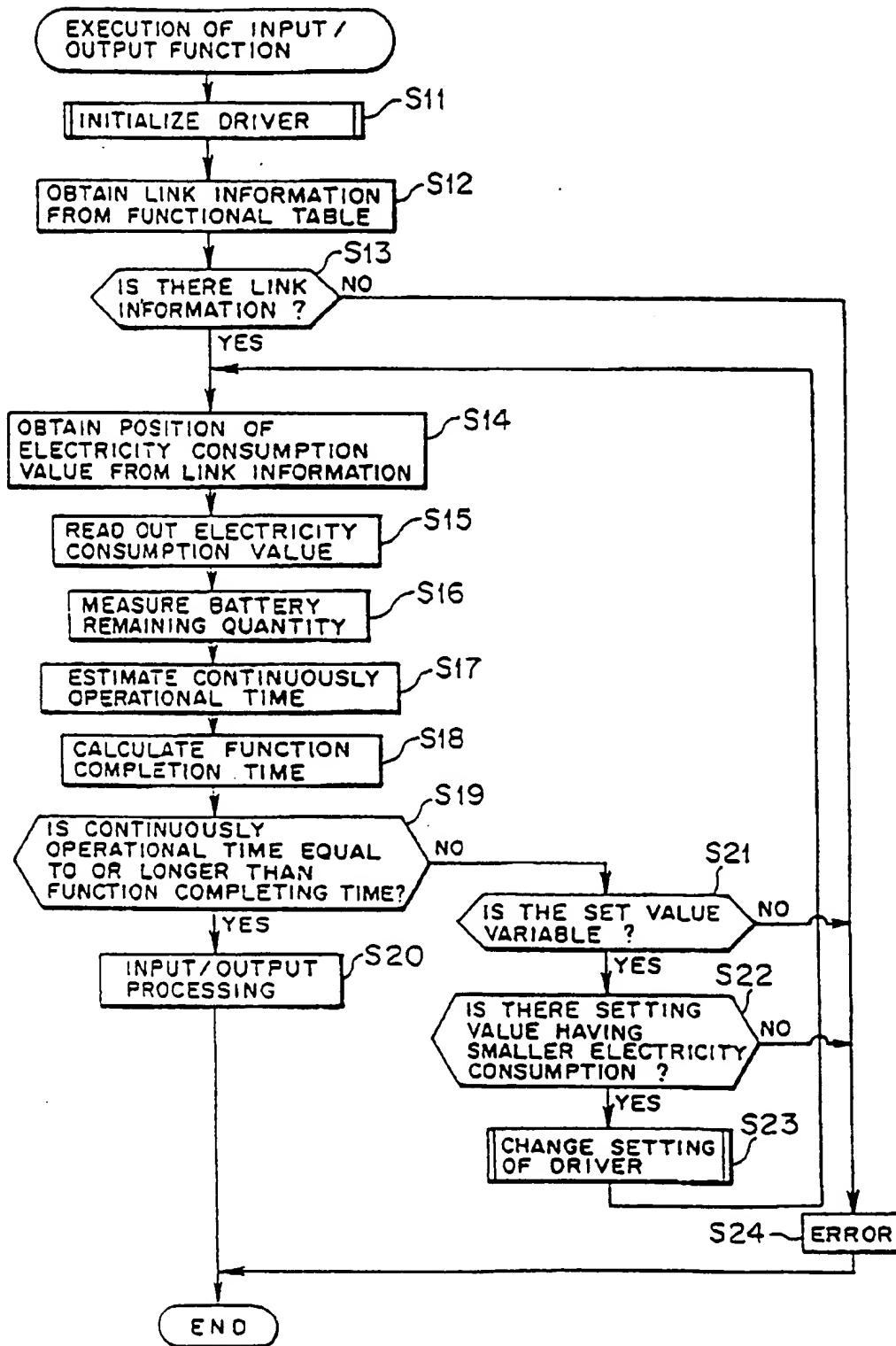


FIG.7

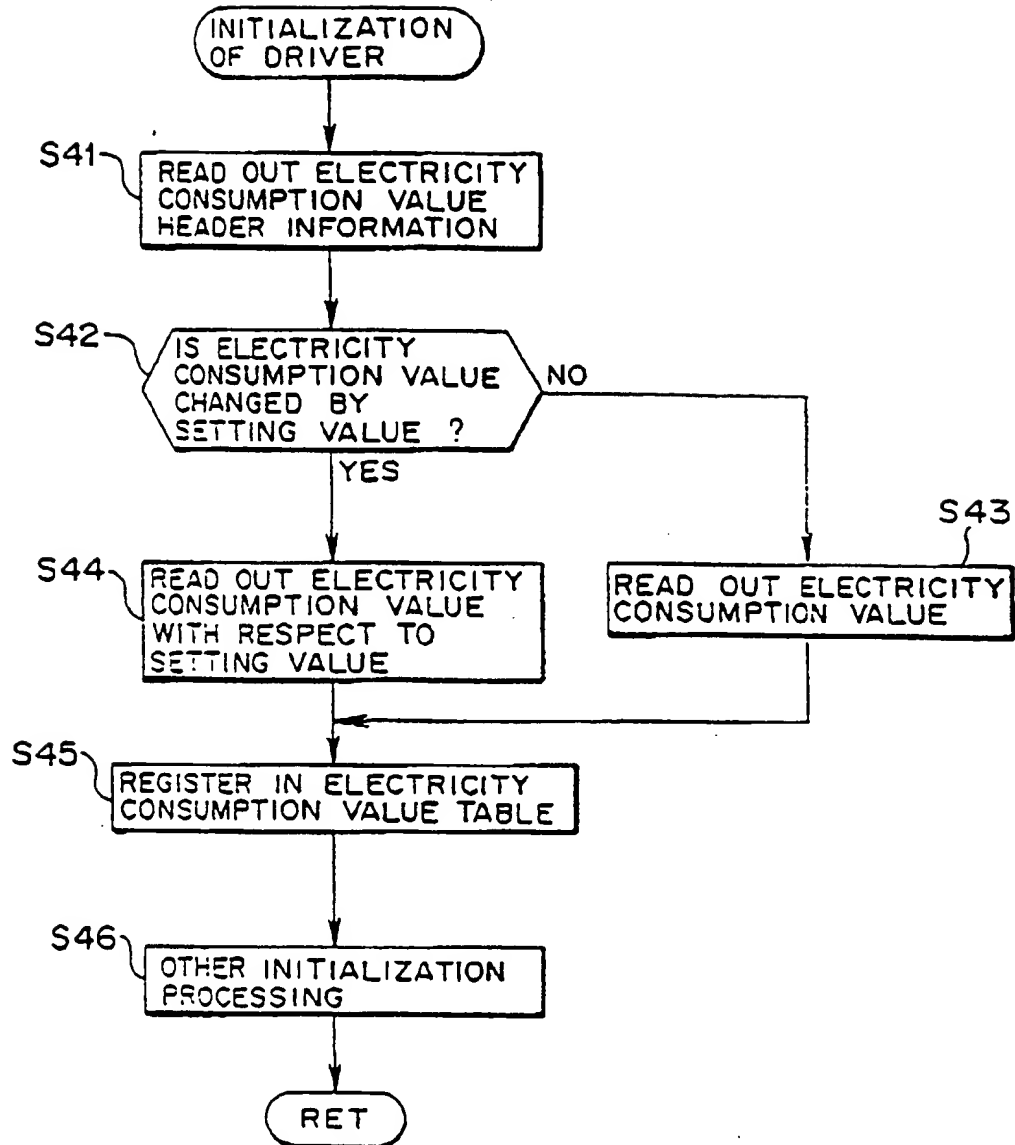


FIG.9

